

DataX: Toward a Justice-Oriented Data Science Program for Secondary Science and Social Studies

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GOAL

To develop a justice-oriented program of learning for data science—**DataX**—that is supported by an integrated curriculum, a web-based learning platform, and pedagogical strategies.

DATA SCIENCE (DS)

An interdisciplinary field that bridges statistics, computing, and disciplinary knowledge, and is focused on examining phenomena with data (Biehler et al., 2022; Hayashi, 1998).

Increasingly relevant to everyday life and has garnered attention in both higher education and K-12 (Lee & Delaney, 2021; Tang & Sae-Lim, 2016).

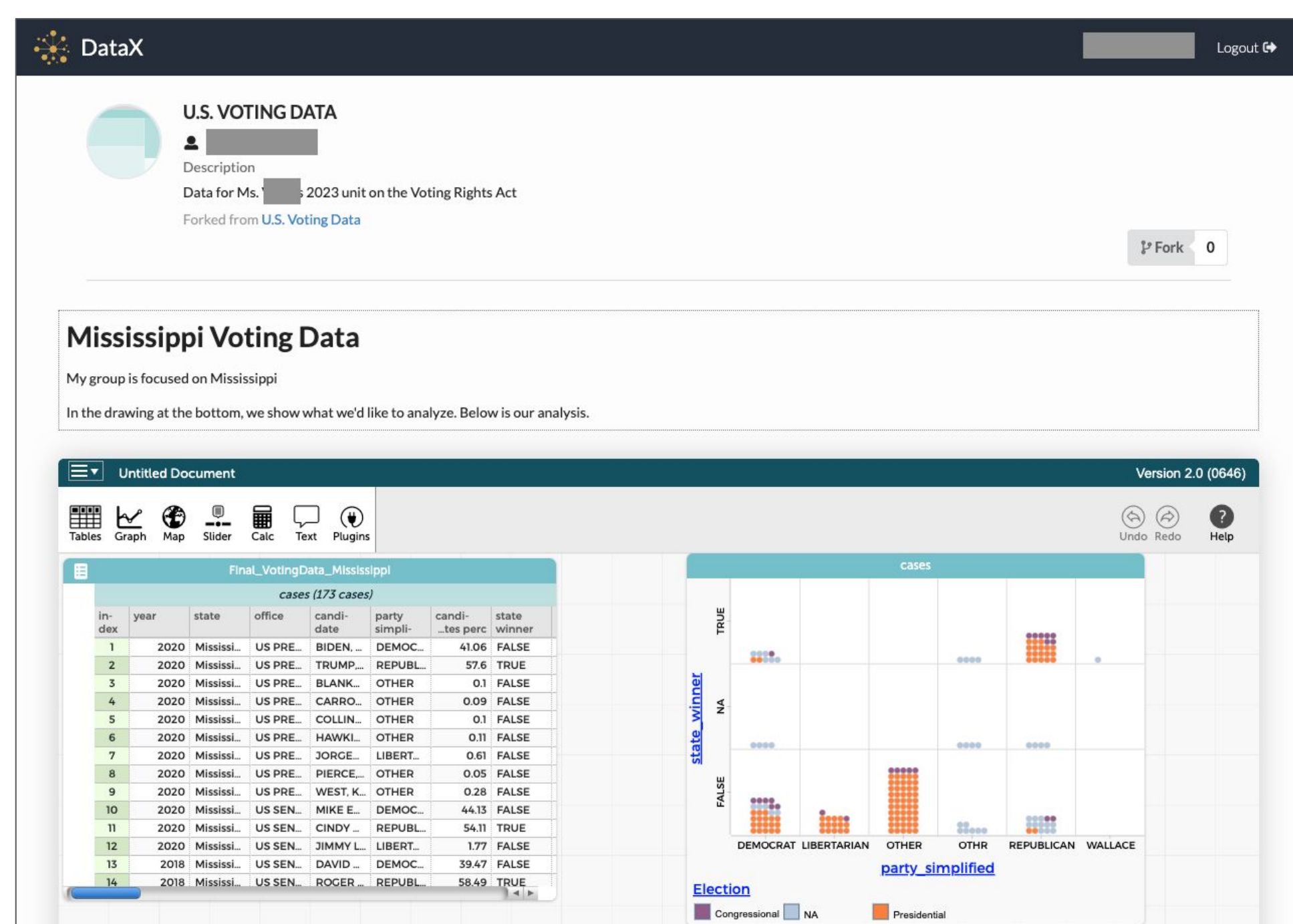
SCHOOL PARTNERSHIPS

We adopted a participatory design approach (DiSalvo et al., 2017) to co-create and iteratively refine DataX with three teachers from a large urban school district in Minnesota.

Over a series of five half-day design workshops, the teachers and the research team worked to collaboratively design the DataX curriculum and refine the DataX learning platform.

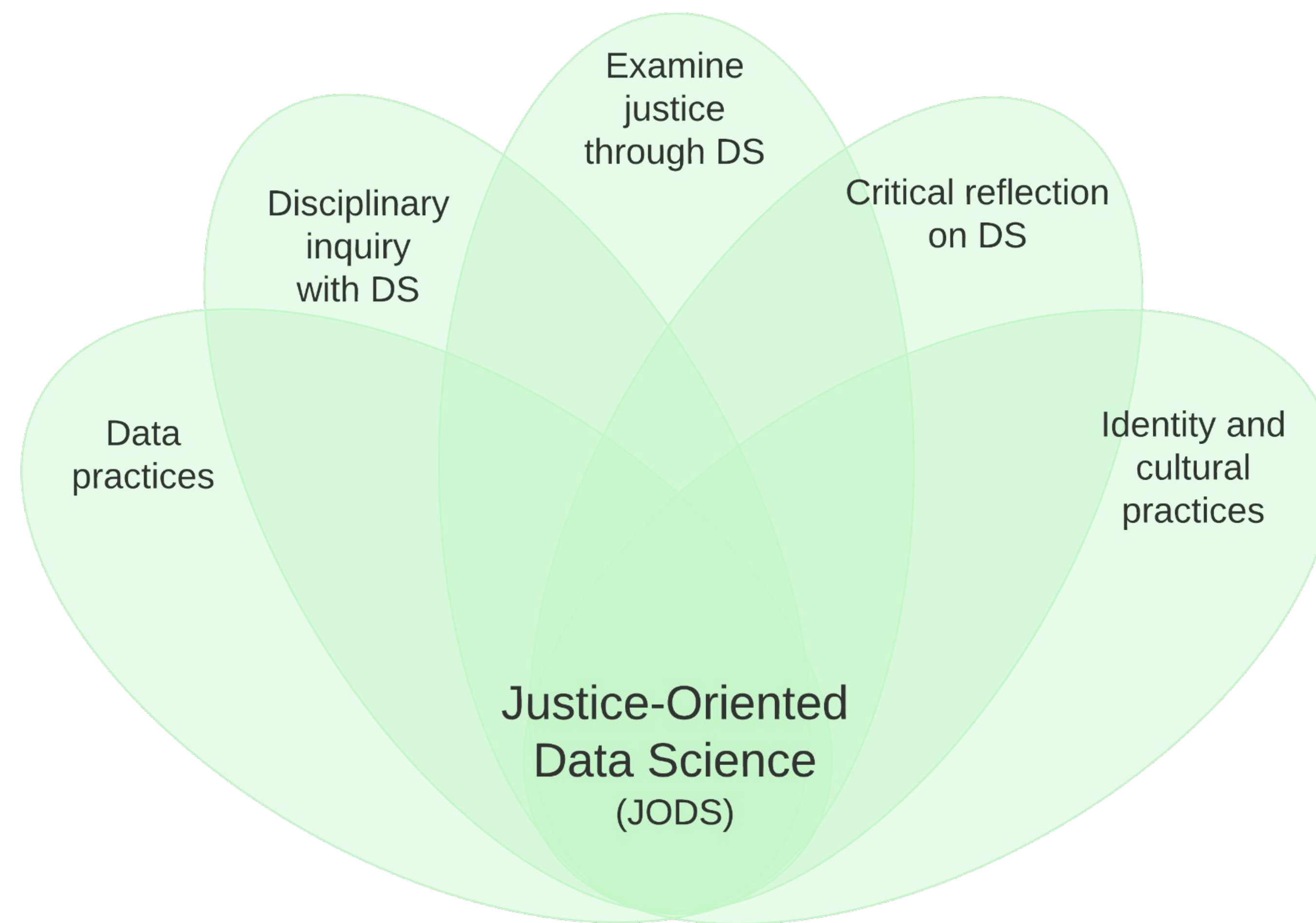
THE DATA X PLATFORM

DataX is a web-based learning environment designed for students to create and collaborate on data science projects. It distinguishes itself from other tools by *socializing* data investigations, incorporating multiple media environments (including CODAP), and intentionally guiding learners to collaborate on data investigations.



CO-DESIGNING DataX: FRAMEWORK, PROCESS, OUTCOMES

Justice-Oriented Data Science Framework



Design Workshops

Transcript	Code
R2: How do we build self-efficacy and overcome reifying beliefs like “I’m not good at math”, or “I don’t understand graphs” so that students believe they can be successful?	DataX Pedagogy Identity and Cultural Practices
R1: And how do we include the idea that oral stories can be more valued in different cultures? Maybe it pushes us to reconsider what counts as data?	Identity and Cultural Practices Critical Reflection of DS
T1: I have an activity where students create data about their favorite superheroes and try to prove which one is best as a low-barrier entry.	DataX Pedagogy DataX Curriculum Identity and Cultural Practices
T2: I have used maps with data as a different access point.	DataX Curriculum Disciplinary inquiry with DS
T1: I wonder if it would be possible to have students find bias in their own work or others and see how it could be improved.	Justice Inquiry through DS Critical Reflection on DS

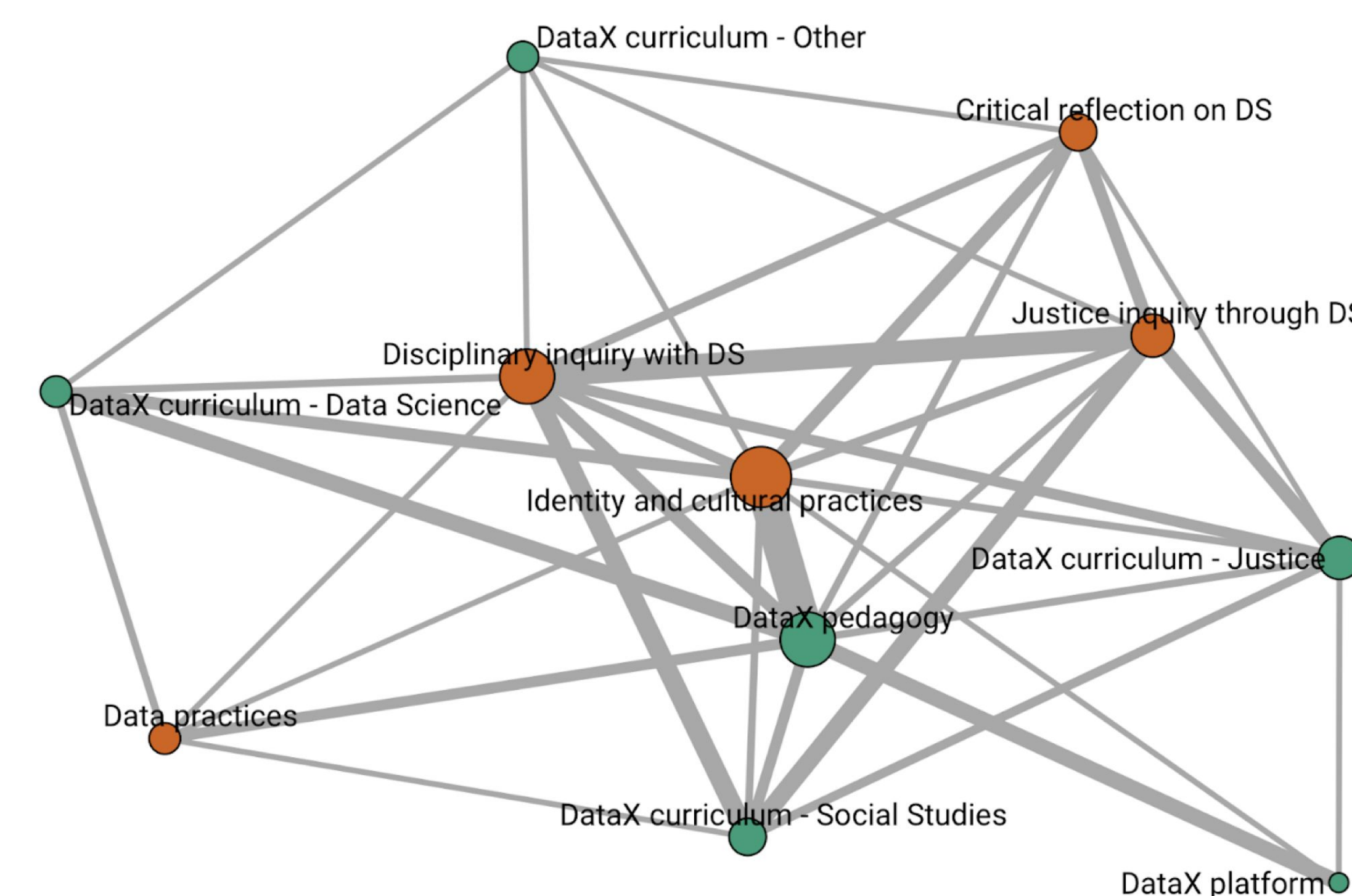
Design Outcomes

GRADE 7 LIFE SCIENCE: QUALITY OF LIFE

Students examined the Child Opportunity Index data and discuss factors important for child flourishing in social and environmental systems.

- Data: Child Opportunity Index, U.S. Census
- Disciplinary ideas: Ecosystems
- Justice issues: Equity in child development
- Critical reflection on DS: People who created the index and human values embedded in these indices

1. **DS practices:** Learners work with data in authentic ways, including wrangling data, making data moves, generating data representations, and interpreting findings.
2. **Disciplinary inquiry with DS:** Learners engage in meaningful disciplinary or interdisciplinary inquiries in which they answer domain-specific questions by analyzing data.
3. **Examine justice through DS:** Learners develop their understanding of justice issues through data investigations.
4. **Critical reflection on DS:** Learners consider the nature of data science as a field, fairness and biases in data science, and connections between data science and society.
5. **Identity and cultural practices:** Learners see themselves as people who use data for purposes that interest them and their communities, and find ways to engage in DS in culturally sustaining manners.



GRADE 11 HISTORY: U.S. Census Data & Du Bois' Visualizations

After studying W.E.B. DuBois' pathbreaking data visualizations on the abolition of slavery, students examined the Voting Rights Act's effect on disenfranchisement.

- Data: U.S. Census (IPUMS; National Archives); Census Bureau
- Disciplinary ideas: Federal legislation's impact on citizen rights
- Justice issues: Voter sovereignty and disenfranchisement
- Critical reflection on DS: Quality of exit polls; Groupings of states in the data set; Causal claims

GLIMPSES OF PILOTS



Figure 1. Student work in the classroom

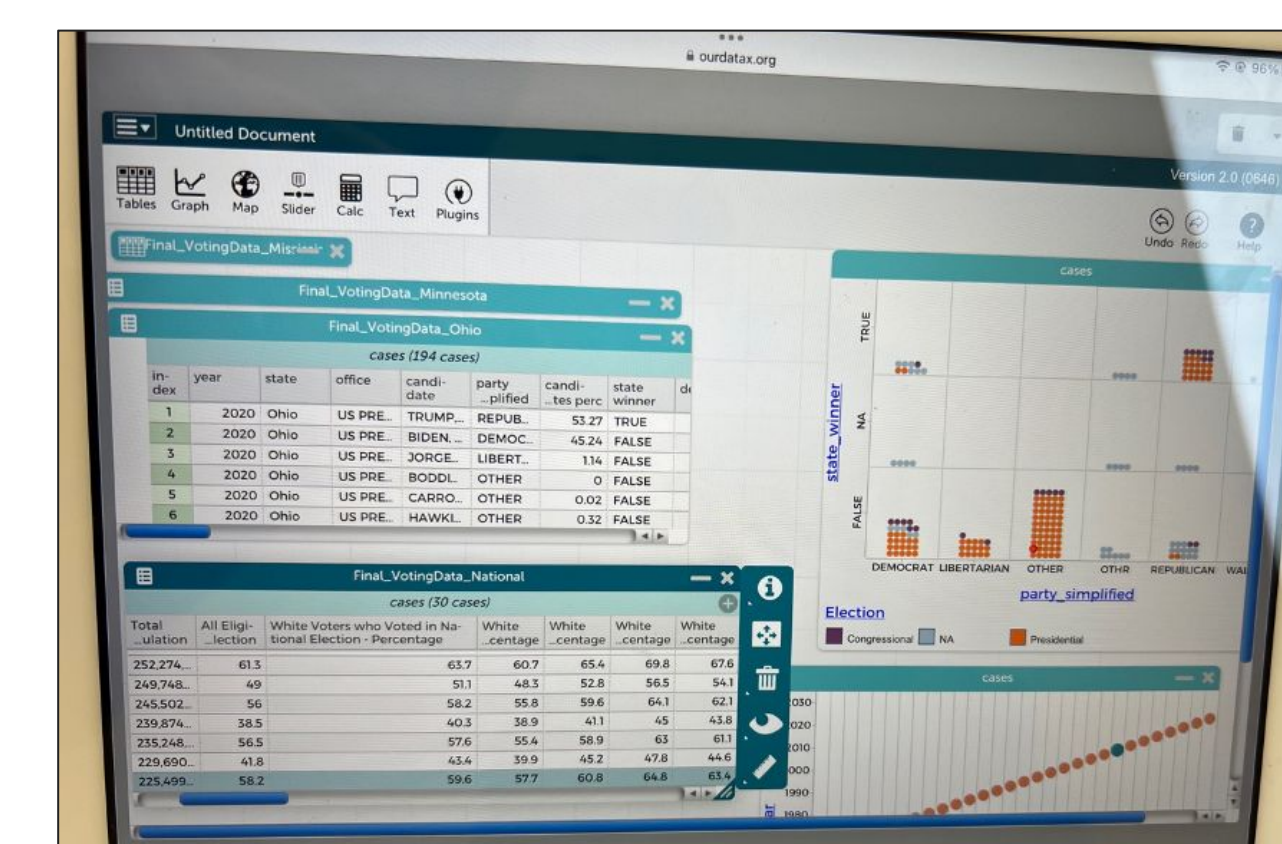
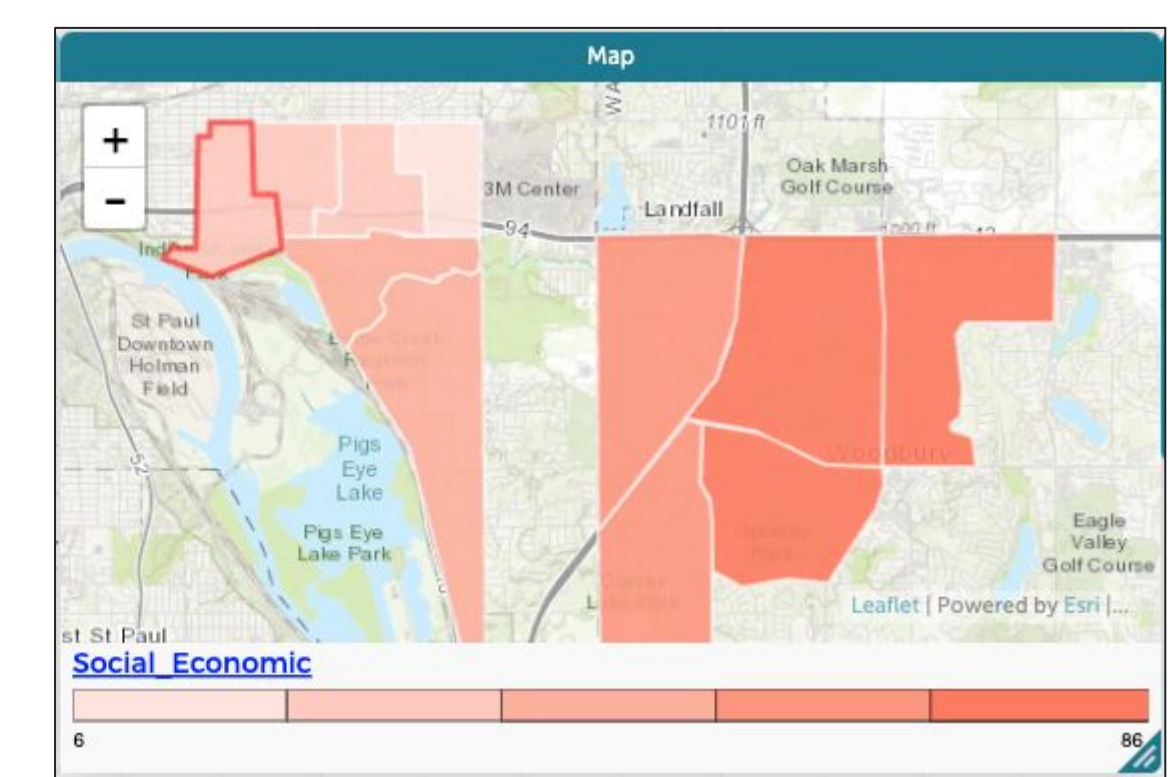


Figure 2. Examples of student projects on the DataX platform

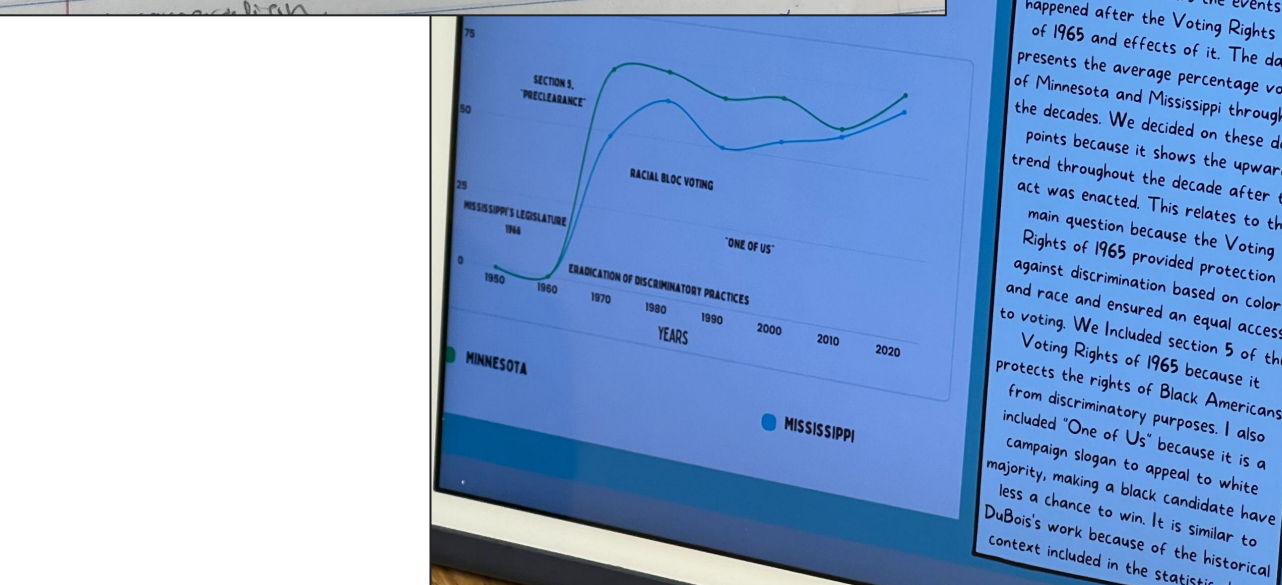
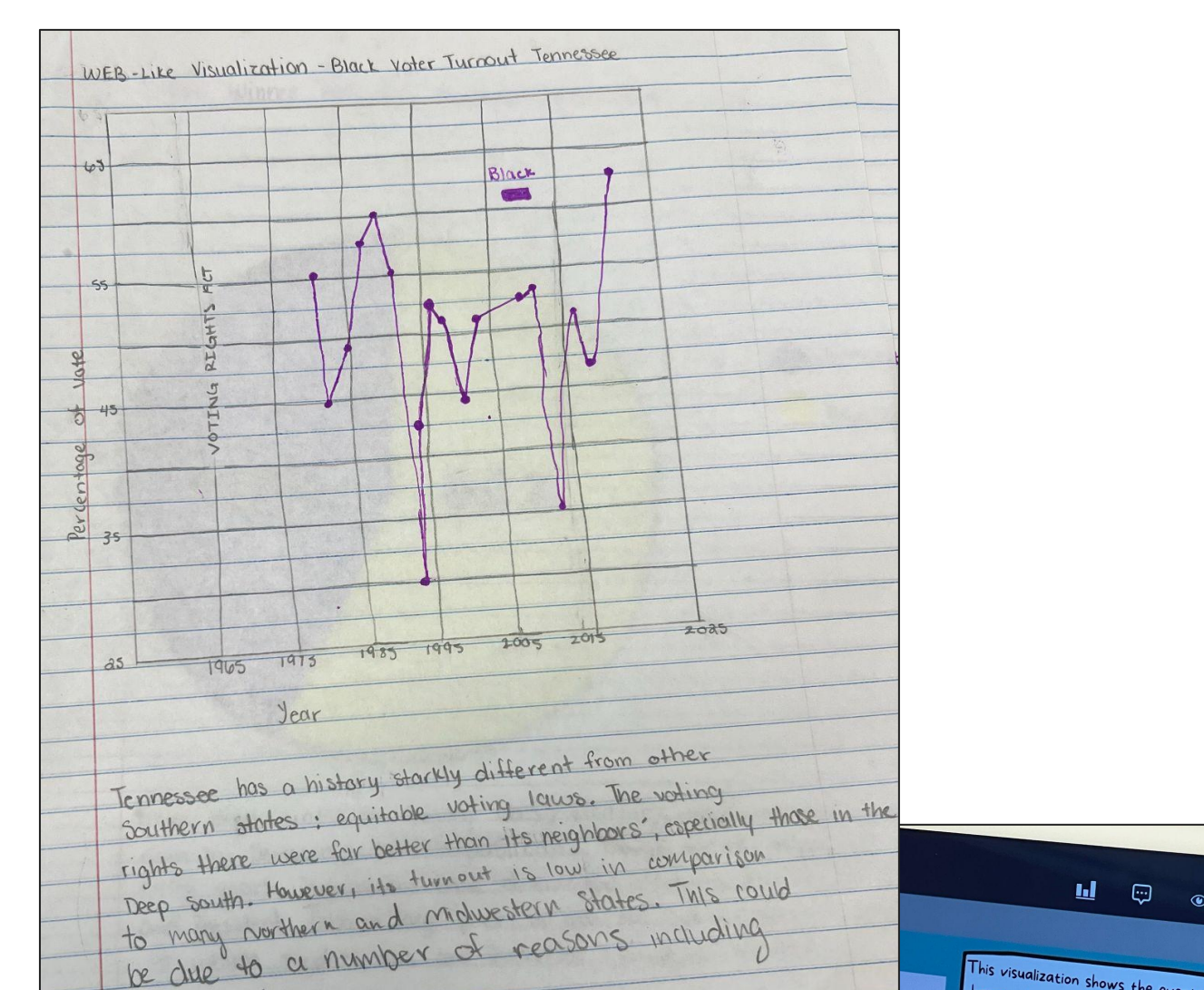


Figure 3. Student-generated visualizations and presentations about their findings



QR code for the poster



QR code for project website